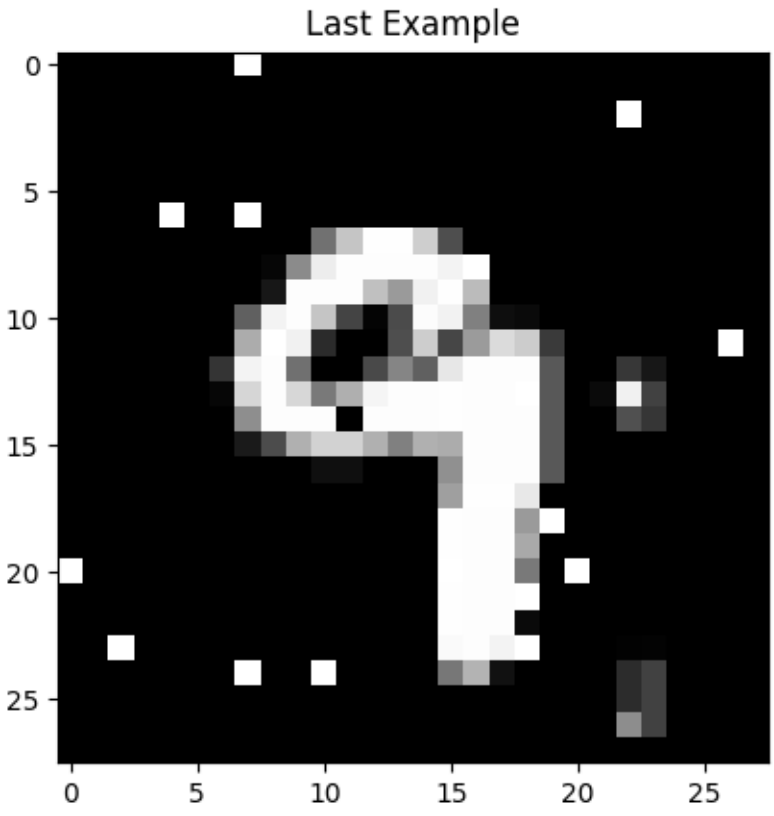
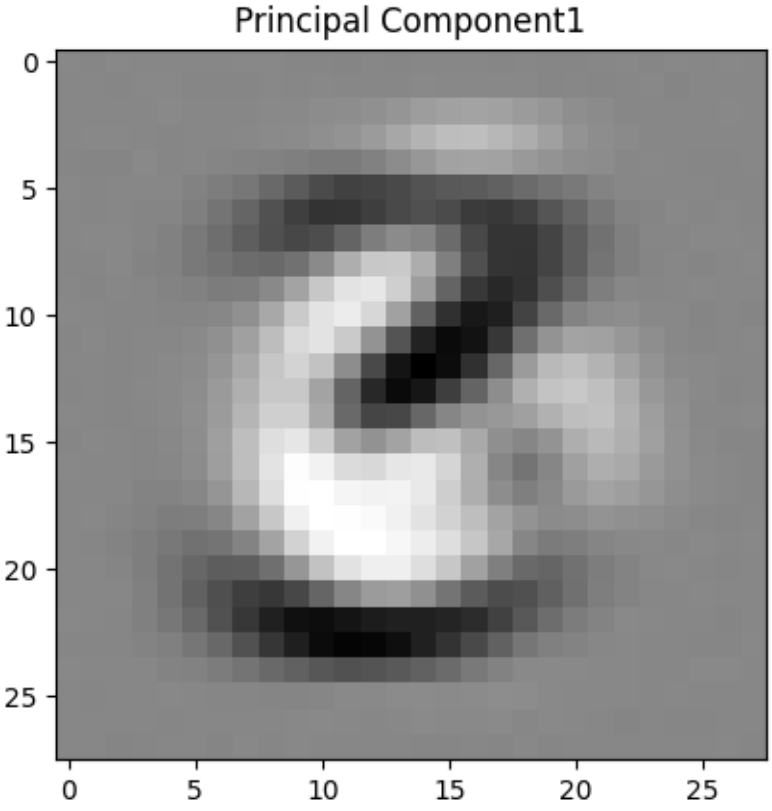
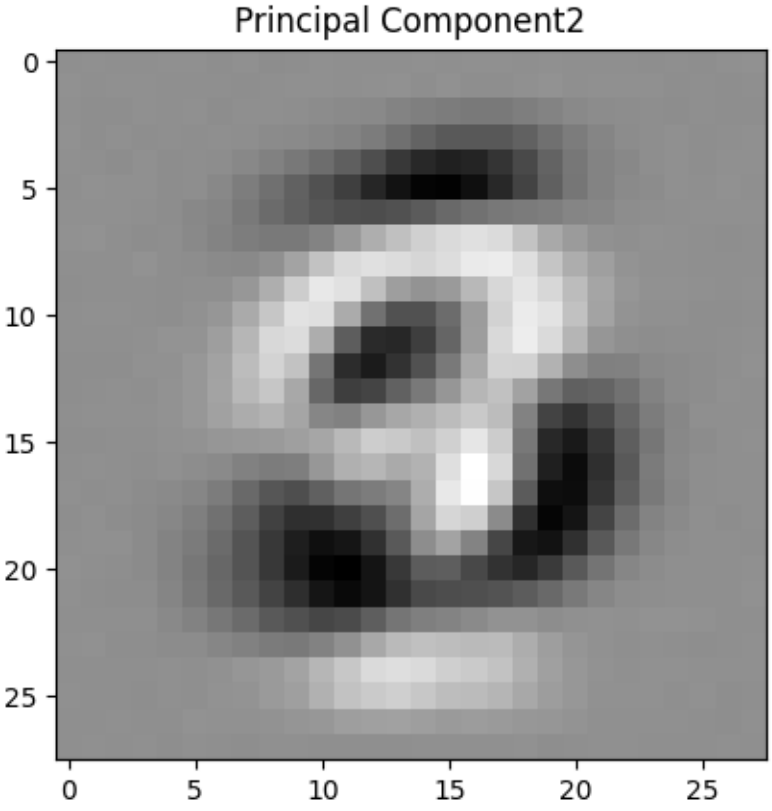
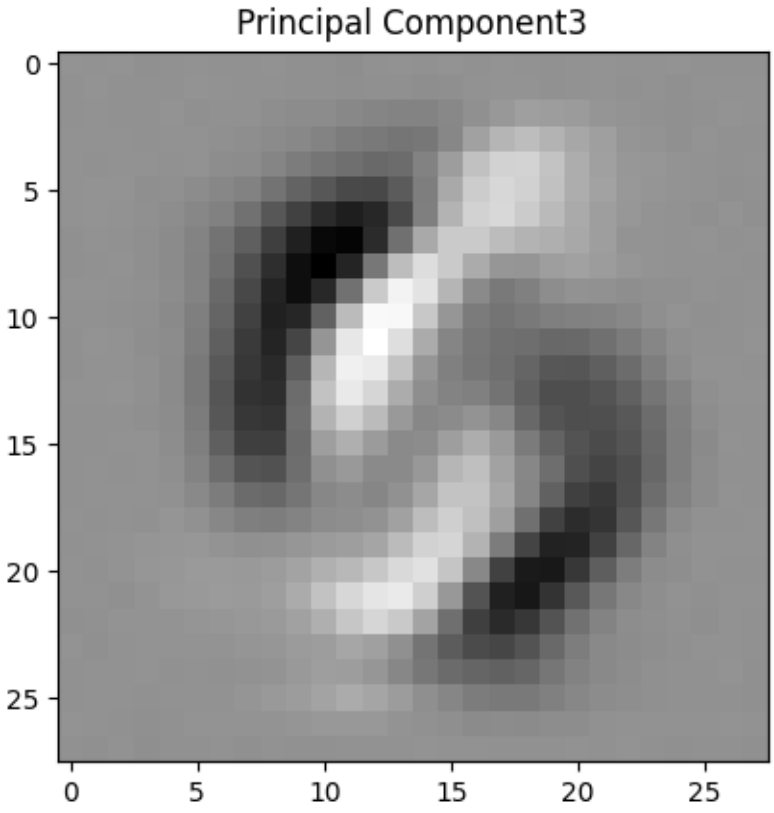
Problem 1a)



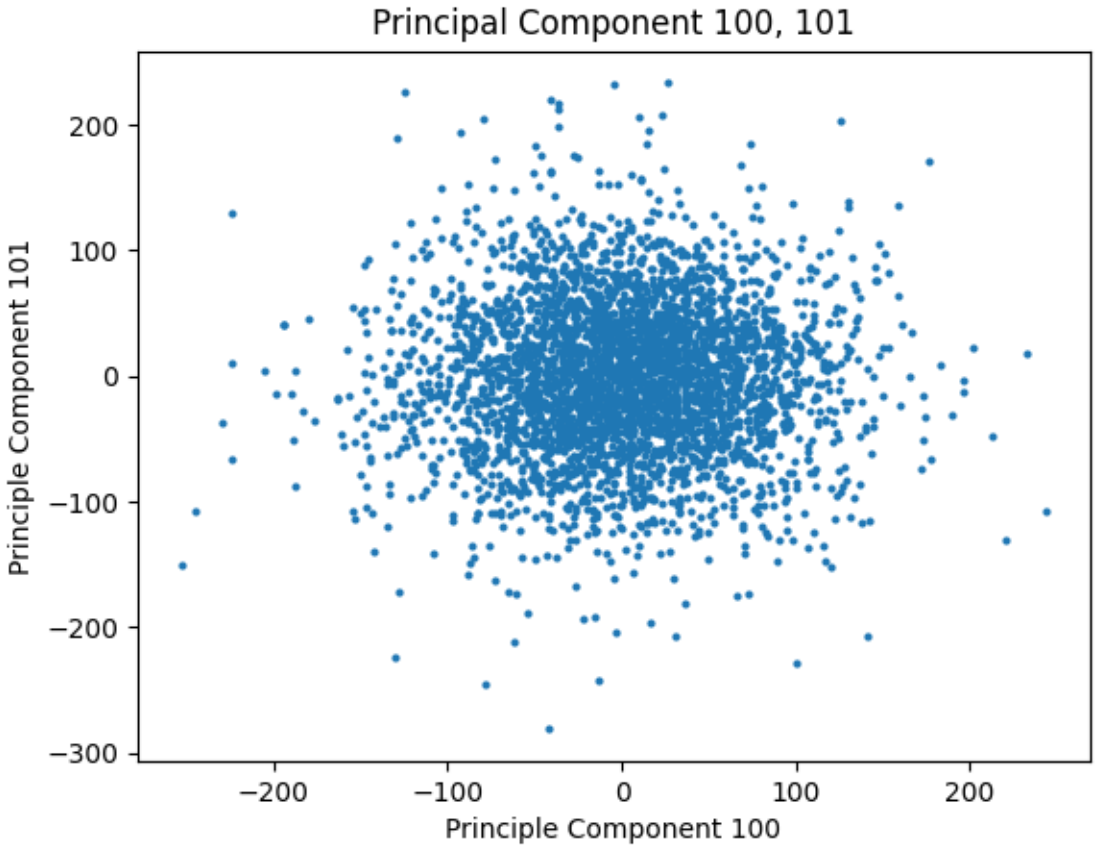
Problem1b)

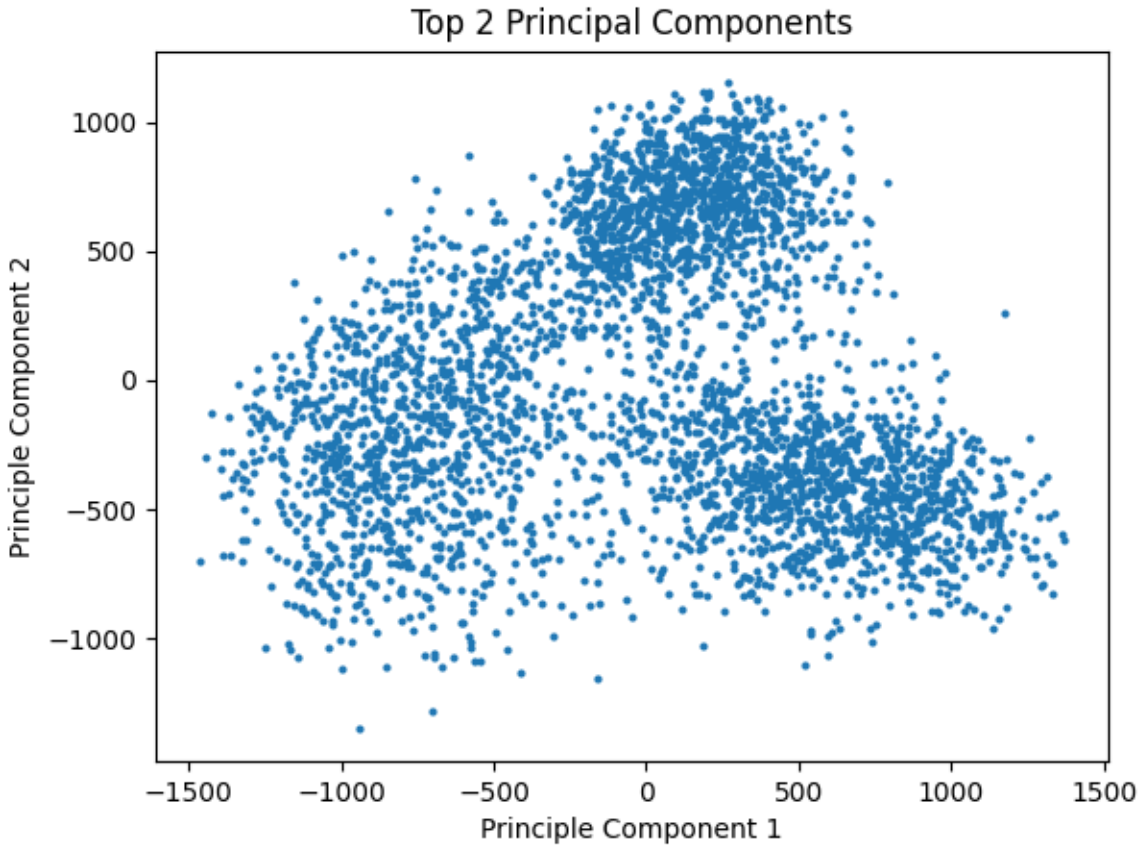

Principal Component1
0
5
10
15
20
25
0
5
10
15
20
25


Principal Component2
0
5
10
15
20
25
0
5
10
15
20
25

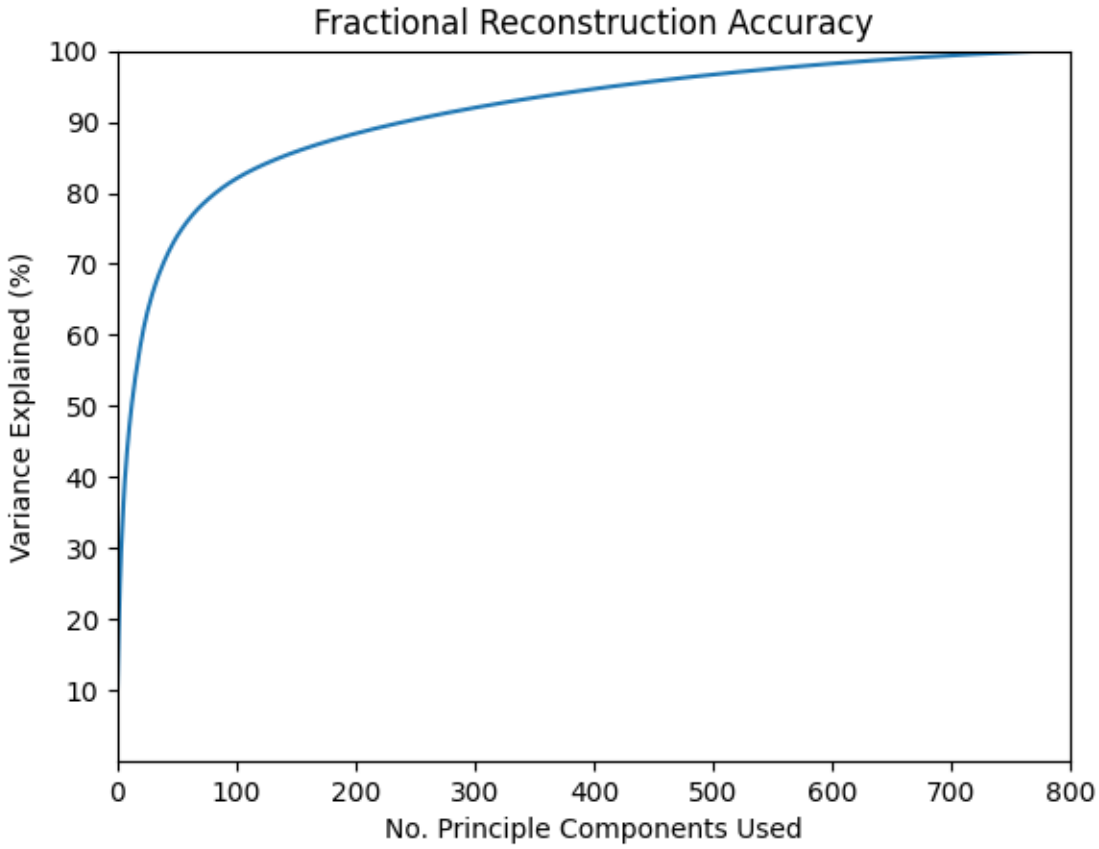


Problem 1c)


Principal Component 100, 101
Principle Component 101
Principle Component 100
200
100
0
−100
−200
−300
−200
−100
0
100
200


Top 2 Principal Components
Principle Component 2
Principle Component 1
1000
500
0
−500
−1000
−1500
−1000
−500
0
500
1000
1500

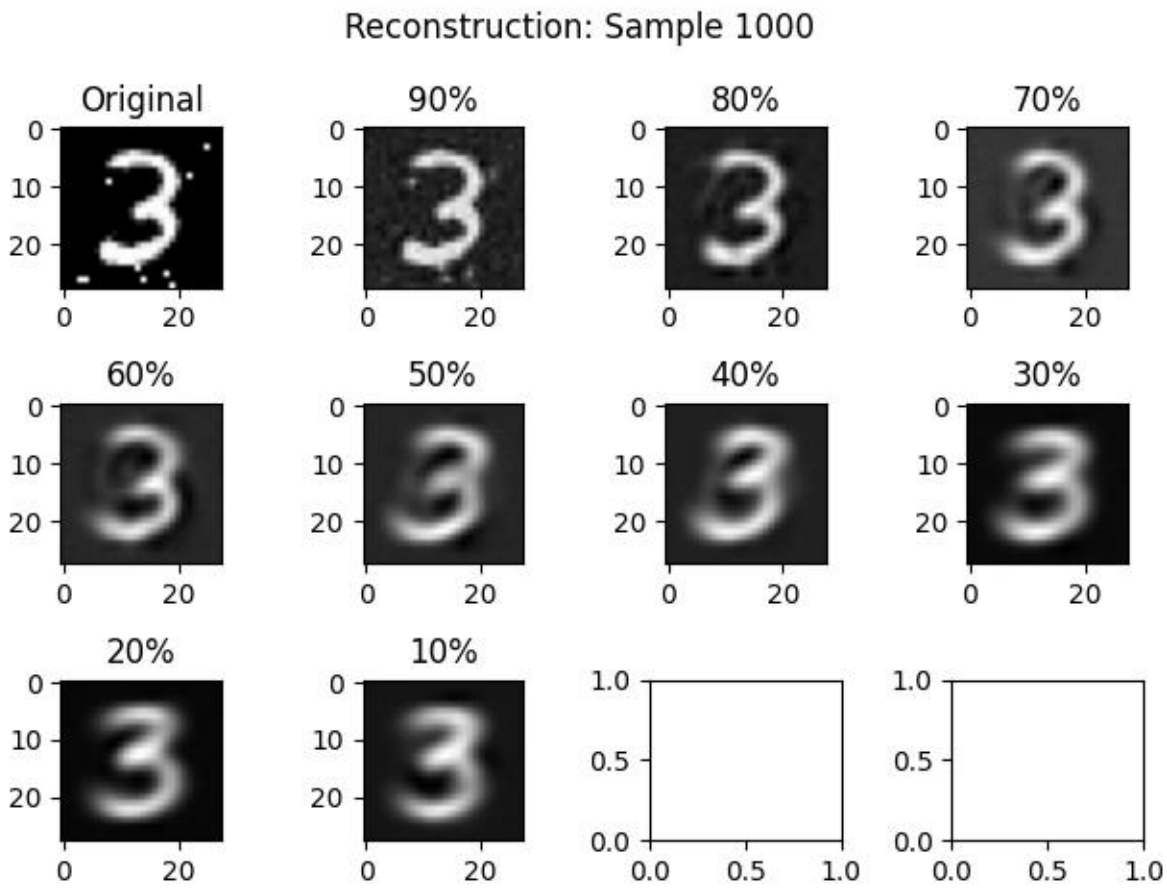
Problem 1d)

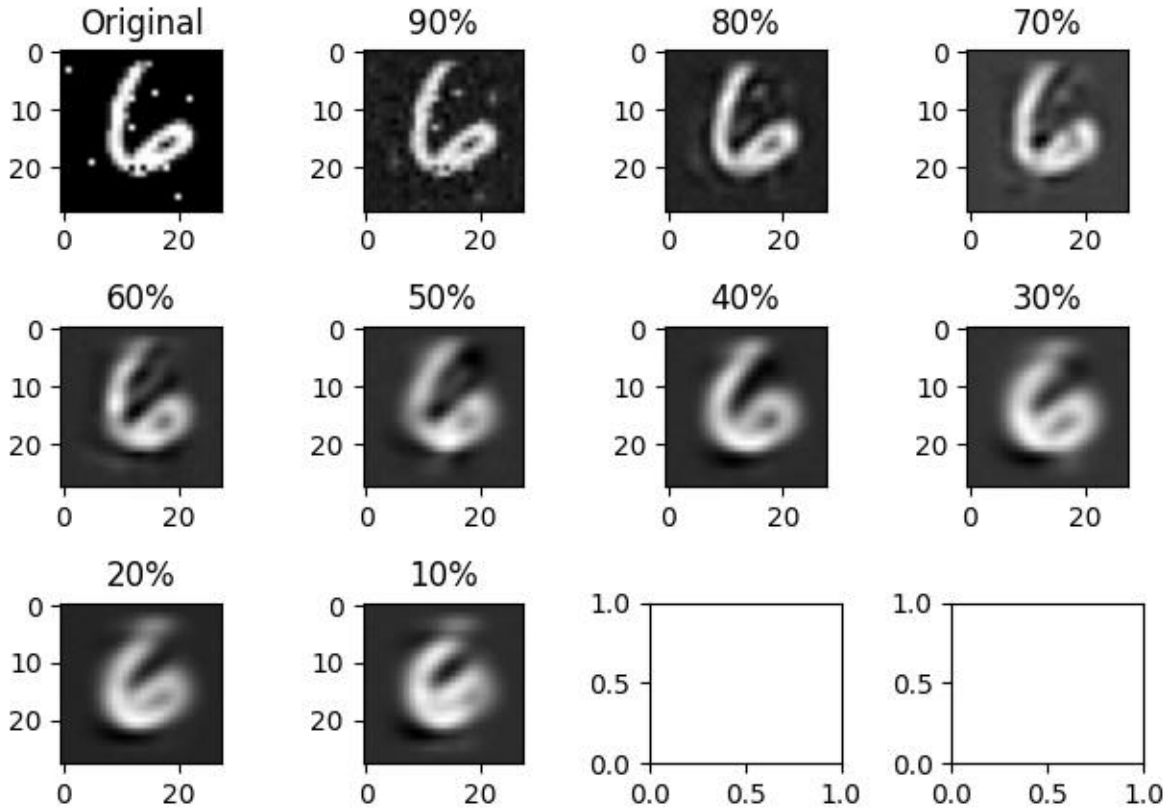


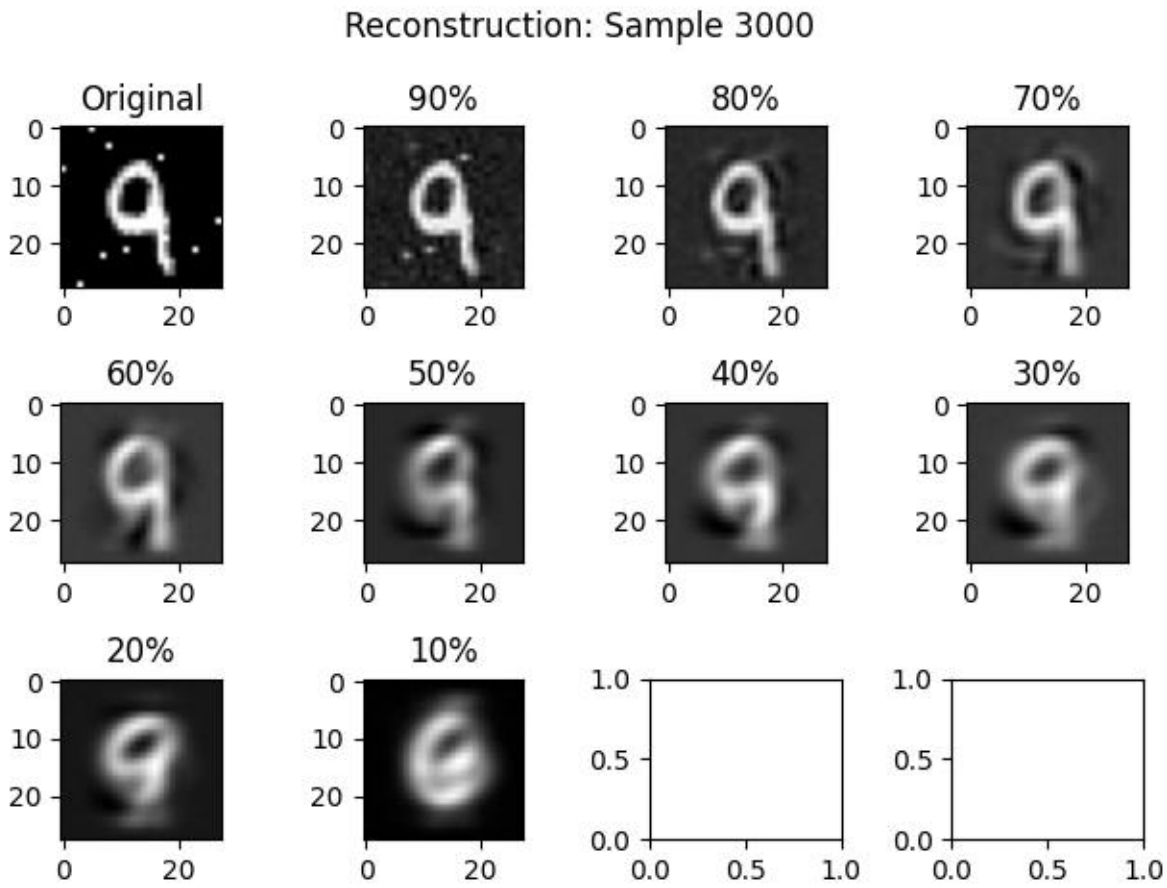
Reconstruction Accuracy No. Principal Components Used

10.0%	**1**
20.0%	**3**
30.0%	**5**
40.0%	**8**
50.0%	**13**
60.0%	**22**
70.0%	**34**
80.0%	**84**
90.0%	**242**

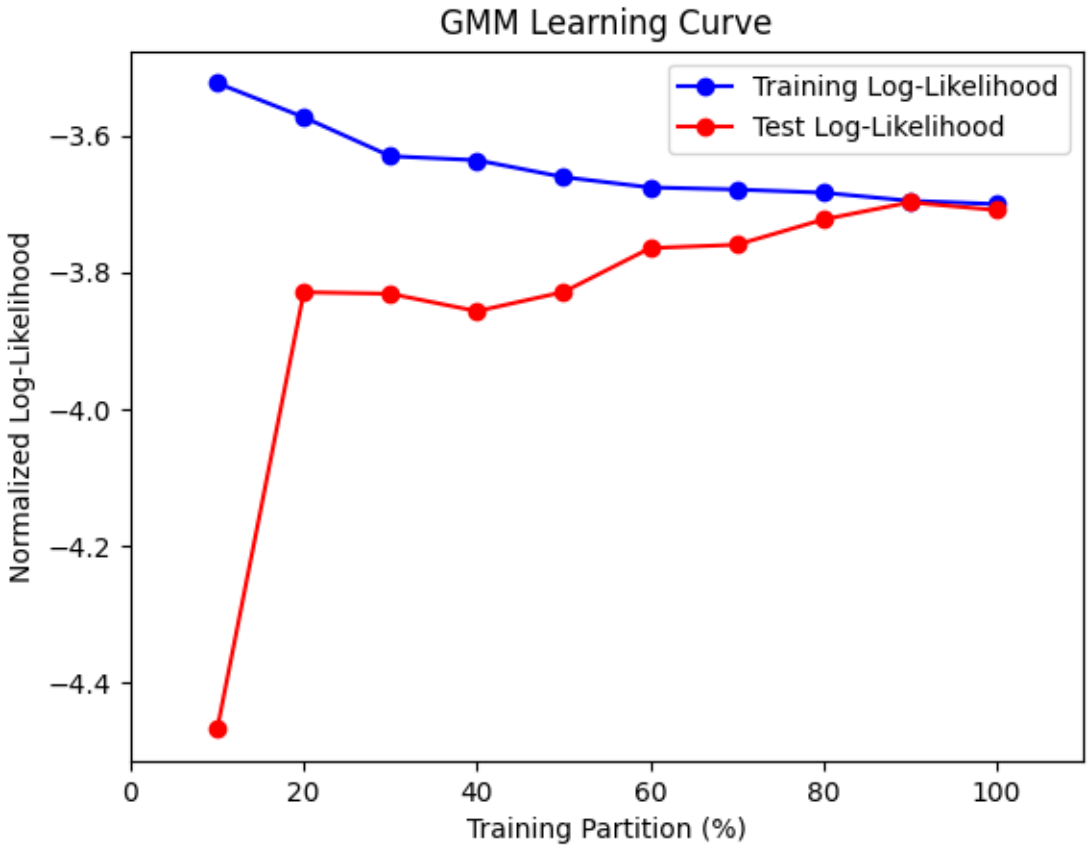
Problem 1e)


Reconstruction: Sample 1000
Original
90%
80%
70%
60%
50%
40%
30%
20%
10%
0
10
20
0
20
1.0
0.5
0.0
0.0
0.5
1.0

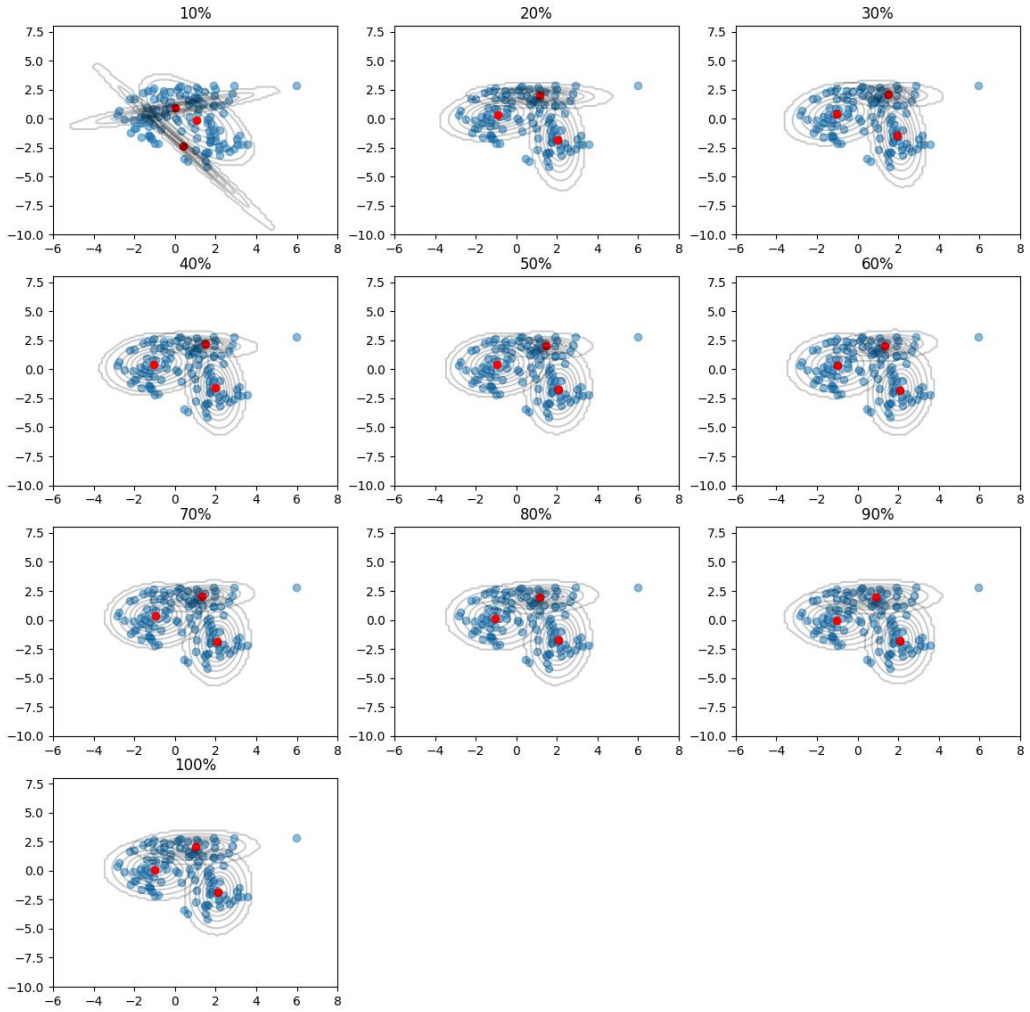

Reconstruction: Sample 2000
Original
90%
80%
70%
60%
50%
40%
30%
20%
10%


Reconstruction: Sample 3000
Original
90%
80%
70%
60%
50%
40%
30%
20%
10%

Problem 3a(i)



Problem 3a(ii)



K **3**

Permutation **100%**

Iterations **26**

Normalized training log-likelihood -3.7002

Normalized test log-likelihood -3.709

---------- ----------

Covariance 1 [[1.492 0.038]

[0.038 0.3047]]

Covariance 2 [[1.159 -0.0773]

[-0.0773 1.1899]]

Covariance 3 [[0.4924 0.0712]

[0.0712 2.4568]]

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Mean 1 [1. 2.0435]

Mean 2 [-0.9782 0.0651]

Mean 3 [2.1283 -1.8328]

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Mixing coefficient 1 0.2887

Mixing coefficient 2 0.3802

Mixing coefficient 3 0.3311

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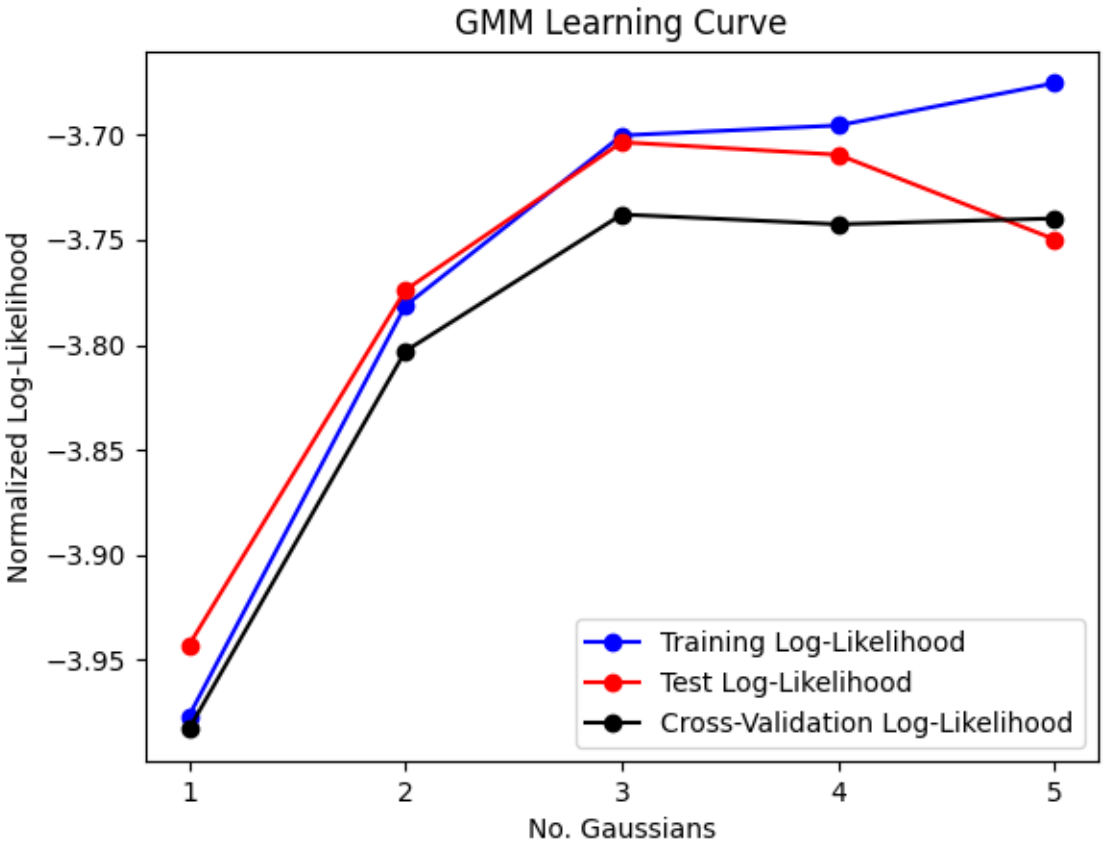
Problem 3b



Selected value of K: 3

Average cross validation log-likelihood -3.7379

Normalized training log-likelihood -3.7002

Normalized test log-likelihood -3.7034

Problem 4b)

E:\Documents\GitHub\Machine-Learning\PS4\ps4-kit\venv\Scripts\python.exe E:/Documents/GitHub/Machine-Learning/PS4/ps4-kit/PS4-P4.py

exp(D_log) =

[[2.50000000e-01 6.00000000e-02 9.60000000e-03 3.84000000e-03

9.21600000e-04 1.47456000e-04 5.89824000e-05 1.41557760e-05

2.26492416e-06 9.05969664e-07]

[5.00000000e-02 1.00000000e-02 8.40000000e-03 4.20000000e-04

1.53600000e-04 1.29024000e-04 6.45120000e-06 2.35929600e-06

1.98180864e-06 9.90904320e-08]]

exp(D_log) =

[[2.50000000e-01 1.00000000e-01 4.00000000e-02 6.40000000e-03

1.02400000e-03 1.96000000e-04 6.86000000e-05 2.40100000e-05

8.40350000e-06 2.94122500e-06]

[5.00000000e-02 5.00000000e-03 2.00000000e-03 5.60000000e-03

1.96000000e-03 6.86000000e-04 2.40100000e-04 8.40350000e-05

2.94122500e-05 1.02942875e-05]]

exp(D_log) =

[[2.5000000e-01 6.0000000e-02 9.6000000e-03 3.8400000e-03 1.5360000e-03

6.1440000e-04 1.4745600e-04 2.3592960e-05 9.4371840e-06 3.7748736e-06]

[5.0000000e-02 1.0000000e-02 8.4000000e-03 4.2000000e-04 7.6800000e-05

3.0720000e-05 2.4576000e-05 2.0643840e-05 1.0321920e-06 1.8874368e-07]]

Process finished with exit code 0